Emissions Market Opportunities for Smaller-Sized Combined Heat and Power Projects: New Value is on the Horizon

D.T.E. 03-121
NSTAR-SEBANE-1-4 (b)

PowerGen International
Combined Heat and Power Session

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Topics

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- What are the potential environmental benefits of small CHP projects?
- What are Emission Reduction Credits (ERCs) and Emission Allowances (EAs)? How do they apply to small CHP projects?
- How can small CHP projects receive ERCs and EAs? What difference would it make?
- What policy issues need further attention?

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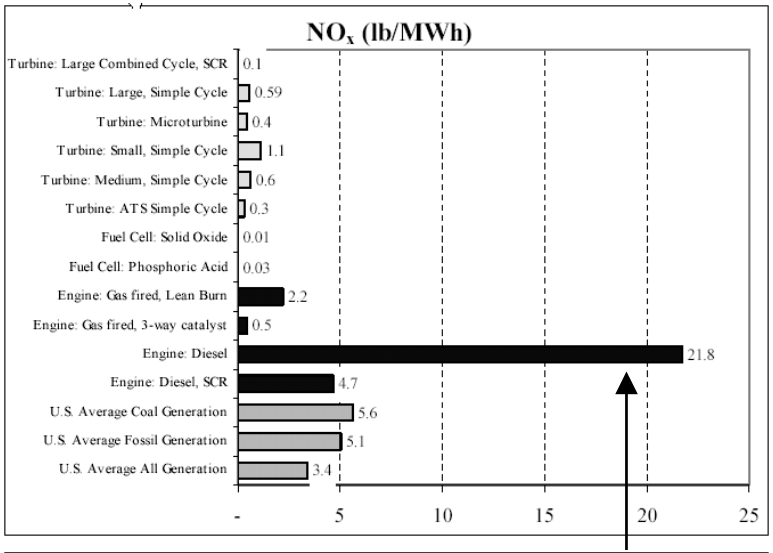
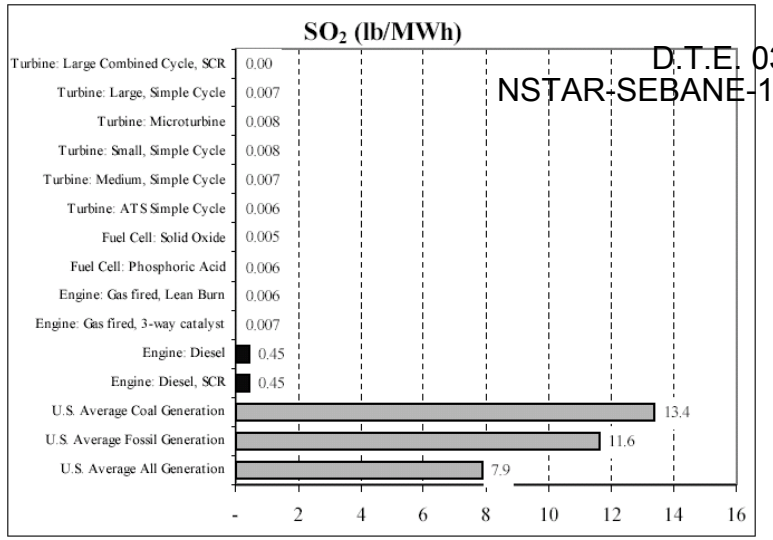
Emission rates of DG vs. central station technology
(CHP rates are lower than DG, depending on the power-to-heat ratio)





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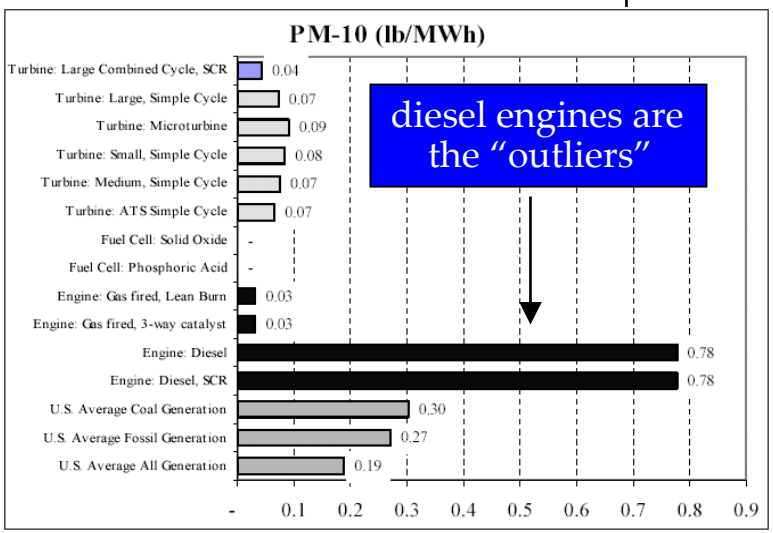

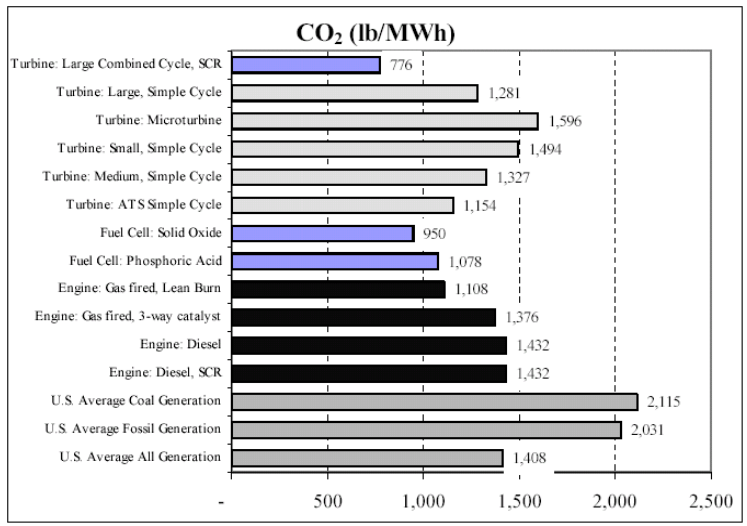

Source: The Regulatory Assistance Project

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Efficiency benefits of CHP vs. separate heat & power (SHP) (*Illustrative*)

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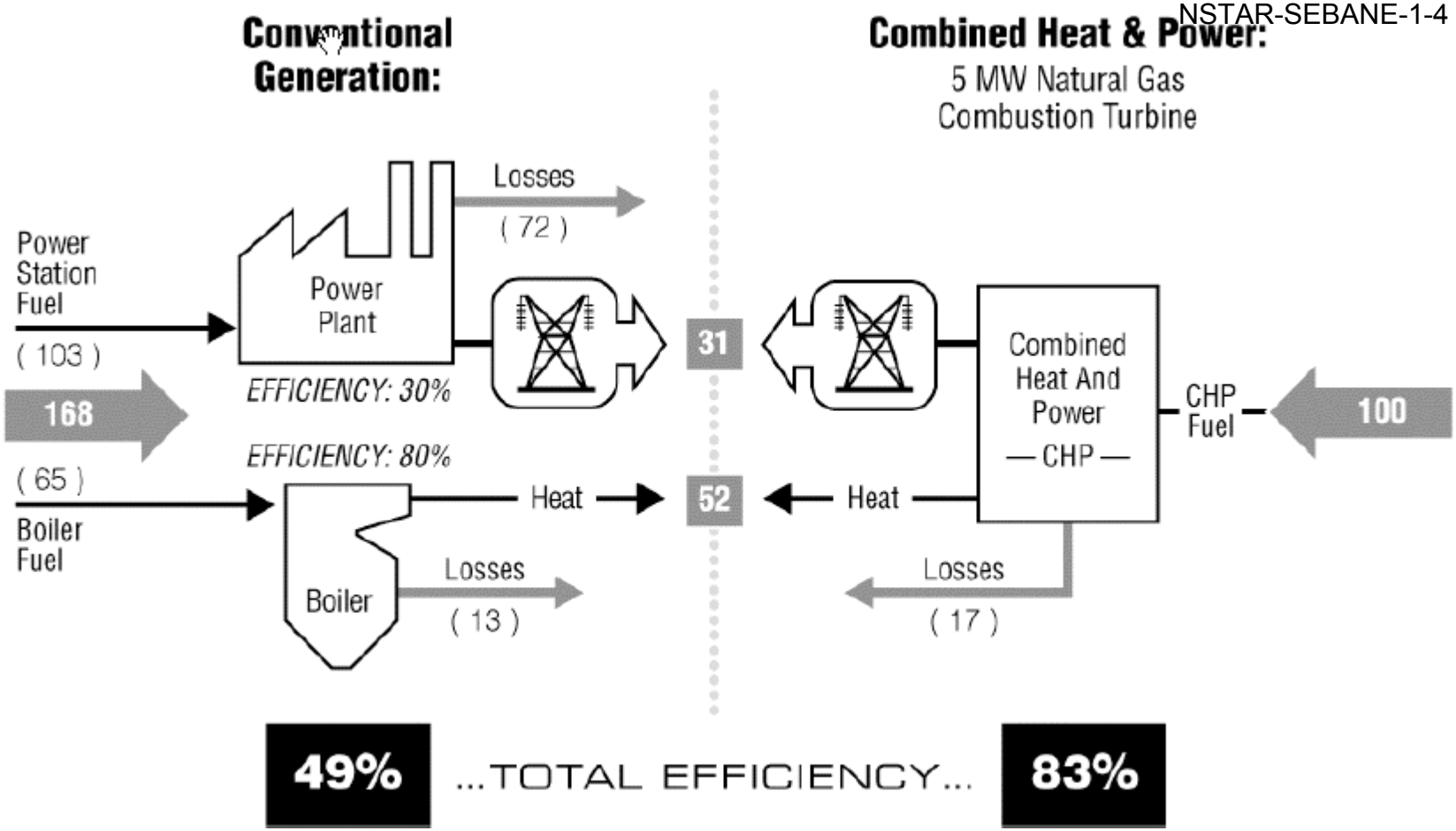

Source: EPA CHP Partnership

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Emission benefits of CHP vs. SHP (*Illustrative*)

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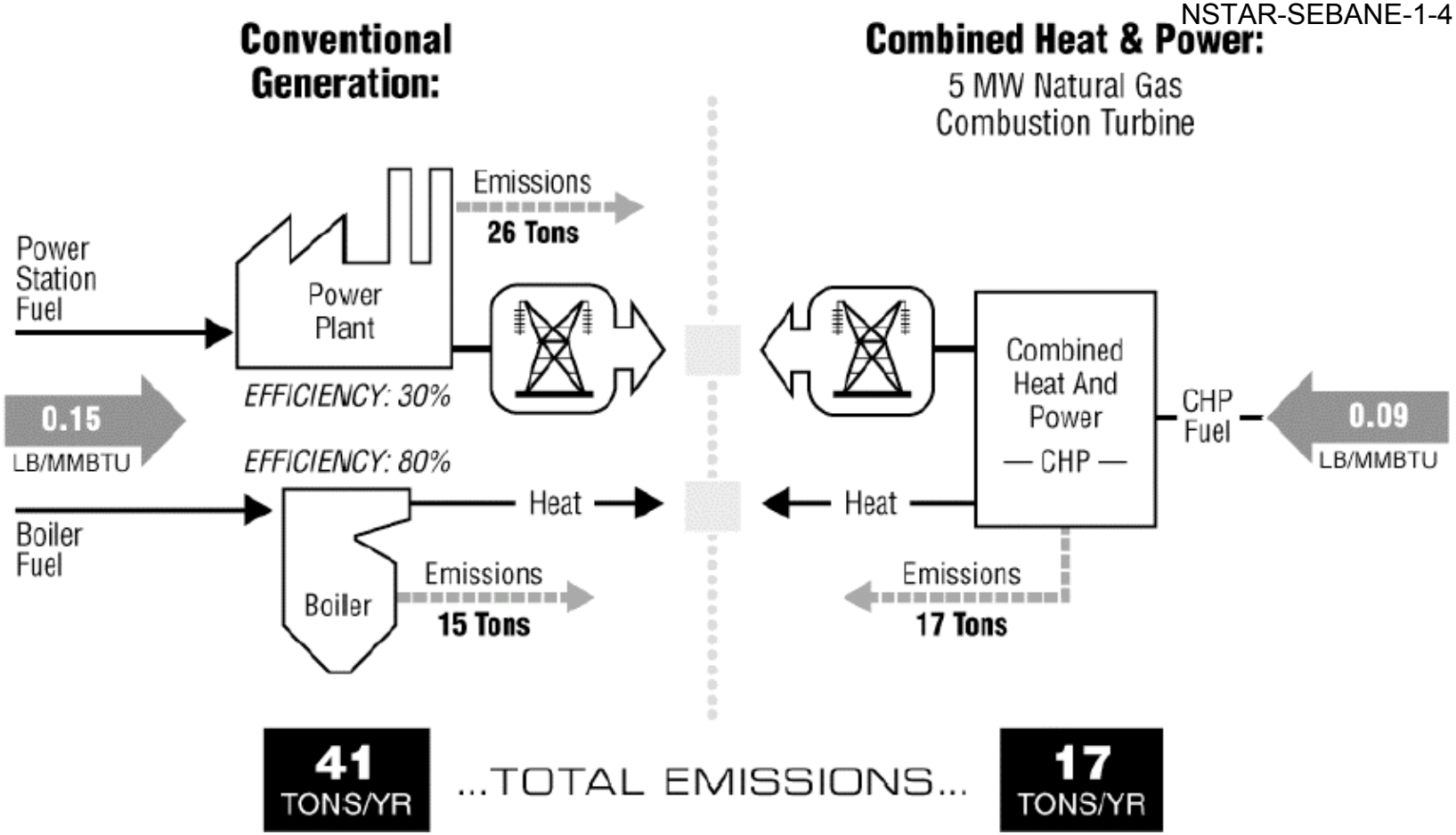

Source: EPA CHP Partnership

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How can CHP monetize these environmental benefits? Through emissions trading markets.

- Emission Reduction Credits (reduced pollution relative to "baseline")
  - ERCs are required as "offsets" for major new/modified sources
  - "Real, quantifiable, permanent and enforceable" reductions from existing sources
  - Includes non-attainment pollutants such as NOx, VOC, CO, PM10
- Emission Allowances (the right to pollute)
  - Used in "Cap and Trade" programs such as the NOx SIP Call
  - State-initiated cap and trade programs are also using allowances
    - MA (CO_2)
    - NH (NOx, SO_2, Hg, CO_2)
    - NY (NOx, SO_2)
- Voluntary Markets (for U.S. participants)
  - International CO_2 markets (Kyoto Protocol)
  - Pilot markets in the U.S. (e.g. Chicago Climate Exchange)

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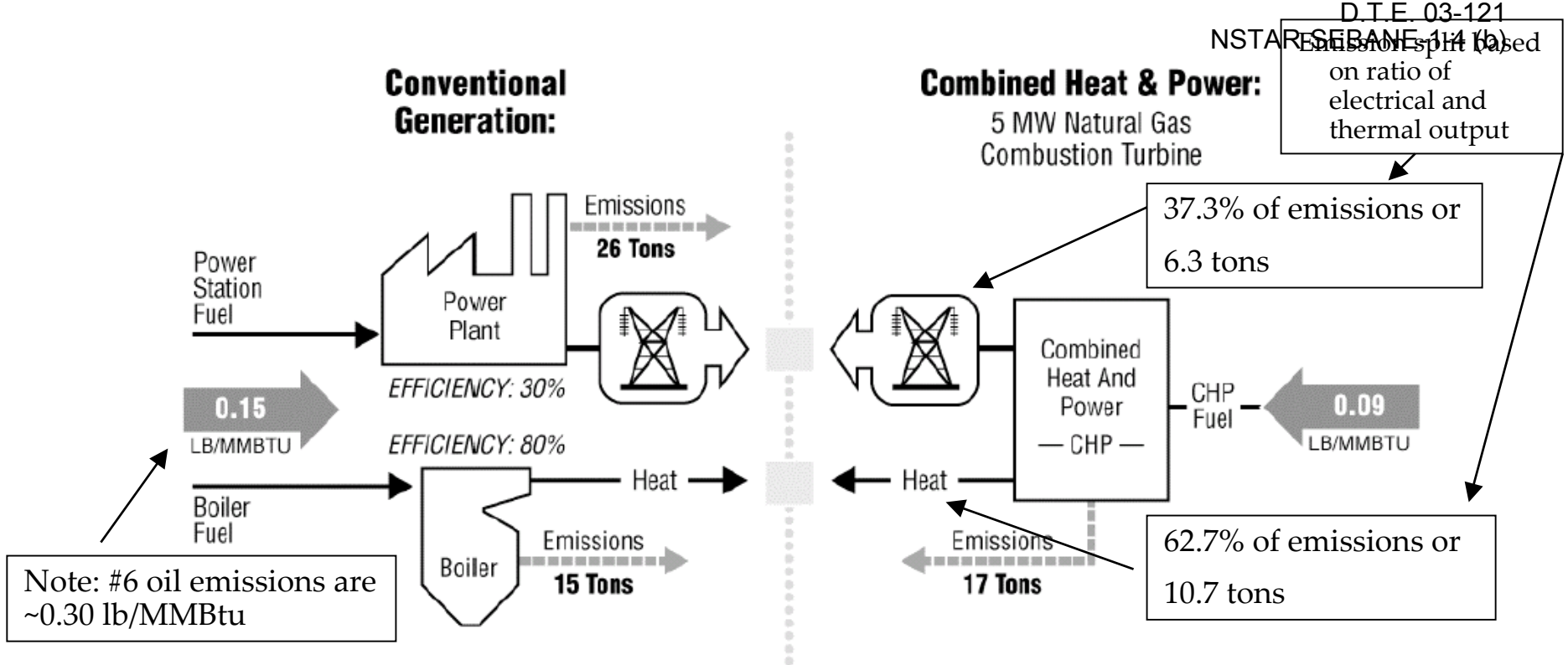
Quantification of Emission Reduction Credit for NOx (Compare CHP thermal-side emissions to old boiler)



ERC =15 tons/year – 10.7 tons/year = 4.3 tons @ ~$10,000/ton = $43,000

If existing boiler uses #6 fuel oil (resid) it emits 30 tons of NOx yearly…

30 tons/year – 10.7 tons/year = 19.3 tons @ $!0,000/ton = $193,000

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There are at least 6 methods to allocate emissions and fuel use between the thermal and electric side of CHP

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Allocation Method	Thermal-Side Fuel Input (and Emissions) Allocation
Pure EGU Method	None
FERC PURPA Method	50% of useful heat recovery
Thermal Output Deduction	Equal to the useful heat recovery (without losses)
Proportional Responsibility	Useful heat recovery as a percentage of total heat and power times total fuel input
Thermal Credit with Proxy Boiler	Fuel use required in an 80% efficient boiler to produce the useful heat recovered
Emission Credit with Proxy Boiler (RAP Model Rule)	Fuel use required in an 80% efficient boiler to produce the useful heat recovered with assumed regulatory emission standard for boilers

There are several issues that complicate prospects for small CHP units obtaining ERCs

- The cost of the process (stack testing, engineering certifications, preparing application, etc.)
- Complexity of the ERC protocol and duration of the review process
- Uncertainties surrounding how the thermal emissions of CHP will be calculated
- The obligation on the applicant to ensure the emission reduction by an enforceable permit condition
- Simplification of the ERC process is needed to increase appeal to small CHP projects. To date, very few have sought ERCs.

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Are small CHP projects affected by cap and trade programs? Usually not at all.

- Generally, electric generators smaller than 15 MW (or thermal sources below 250 MMBtu/hour maximum fuel input) or units with severely limited operating hours, are not subject to emissions cap requirements.

  — If small CHP & DG sources are not included in the cap, the cap will not fully cover the electric generation sector. Assuming DG/CHP is widely adopted, this could erode the intended emissions benefits of the cap – making it a "permeable cap."

- Small CHP is by definition, not an affected source – but small units can "opt-in" to the program. Opt-in enables sources to receive an allowance allocation using the same formula applicable to large generators; opt-in units must surrender enough allowances to cover their emissions.

- CHP may be eligible for "set-aside" allowances intended to promote renewables and energy efficiency. Very few states have explicit provisions for CHP set-asides.

  — Renewables and efficiency are awarded 1.5 lb/NOx for each MWh produced or saved, respectively. Awards typically run for 3-5 years.

SOURCE: 23-21 NSTAR-SEBANE-1-4 (b)

Opt-in provisions for small CHP

- We often think of regulation as a burden rather than an opportunity. For clean CHP projects, being a part of cap and trade programs could offer additional value by obtaining surplus allowances and then selling them.
- Including small CHP units would help to preserve the intended goals of the electric sector emissions cap since small CHP units can and do displace large central station plants. Displacement from sources outside the "cap" places downward pressure on allowance prices, and thereby discourages emission control projects. When this happens, the displaced emissions eventually go back in the air.
- Opt-in units are subject to the same rules and procedures as large generating units and boilers. Some of these provisions are non-starters for small CHP.
    - Continuous emissions monitoring equipment and procedures
    - Opt-in would be of no benefit for high emitting CHP units, such as diesel IC engines, and could actually be very costly.

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Opt-in provisions for small CHP (cont'd)

- Emission allocation formulae frequently differ between electric generators and large boilers. For this reason, the CHP unit opting-in should "unbundle" its emissions and fuel usage into electric and thermal components (using an appropriate formula, among the 6 shown earlier). The CHP unit then opts-in as both and electric generator, and a thermal generator. This can be described as "combined opt-in" for combined heat and power.

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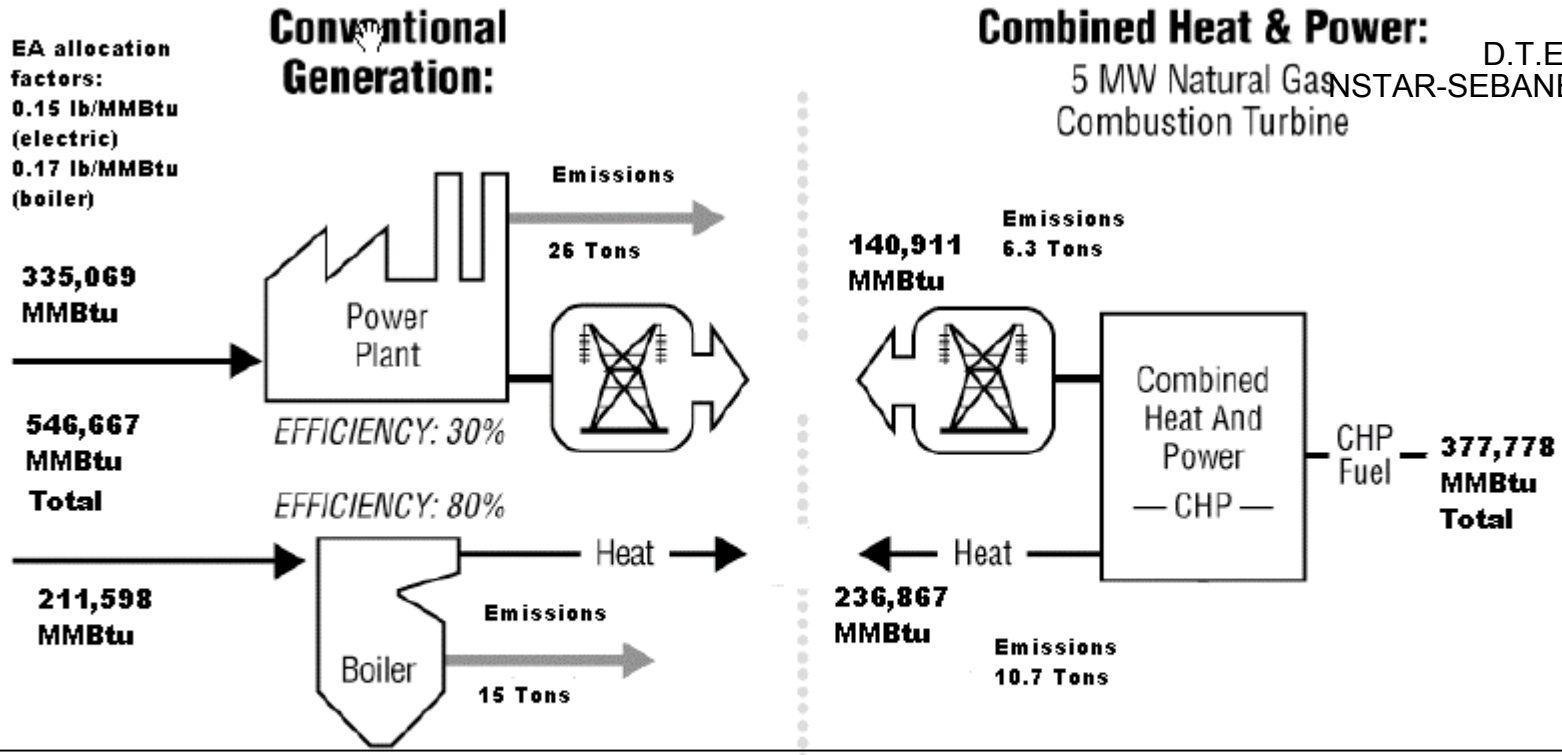
Example of "combined opt-in" for CHP
Creates $15,000 per year of net allowances (@ $3,000/ton)



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Electric-side CHP opt-in:	140,911 MMBtu * 0.15 lb/MMBtu = 21,137 lbs. or 10.6 tons of EAs	
Thermal-side CHP opt-in:	236,867 MMBtu * 0.17 lb/MMBtu = 40,267 lbs. or 20.1 tons of EAs	
Combined CHP opt-in:	30.7 tons	
CHP total emissions:	17.0 tons	
Surplus Allowances:	12.3 tons	**Ozone Season Portion** (@5/12) = **5.13 Tons per year**

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Opt-in Considerations

- Opt-in mechanism has an unlimited lifespan. Set-aside allowances are typically limited to 3-5 years.
- Opt-in example and the ERC example are additive – they do not present a double counting problem.
  - ERC calculation compares the thermal-related emissions of the CHP system to the old boiler's emissions.
  - The opt-in calculation merely treats the thermal and electric aspects of the CHP system as if separate heat and power. It does not take credit for the avoided boiler emissions.
- Combined-opt in does have a few potential wrinkles
  - May lead to small CHP being treated differently than large CHP. If this is a problem, the opt-in mechanism can be altered for consistency
  - Some jurisdictions may impose limitations that prevent allocation of more allowances than the maximum permissible total emissions. This may dampen the benefits shown in the example.

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How would a set-aside mechanism work for small CHP?

- A set-aside process would be almost identical to the opt-in

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  - Allowances would be taken from electric and thermal set-aside accounts, and awarded to the CHP unit, net of the respective thermal and electric emissions. Alternatively, the set aside could use the same allocation formula that applies to large CHP units.
  - Similar need for streamlined provisions for emission monitoring and reporting.
  - Would probably be limited to 3-5 years like renewable and efficiency measures.
  - Could sweeten the pot by <u>also</u> giving "bonus allowances" for the reduced amount of electrical generation required by a distributed generation resource relative to a central station plant, which faces T&D losses of approximately 9% on average.

How significant is the impact of the proposed ERC and NOx EA mechanisms?

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	Number 2 Oil in Old Boiler	Number 6 Oil in Old Boiler
ERC Value (one-time event)	$43,000	$193,000
Annual NOx EA Surplus	$15,000	$15,000
Net Present Value of NOx EA @ 10% discount rate over a 15-year period	$114,090	$114,090
NPV of 9% EA bonus for avoided T&D losses for 15 years	$22,800	$22,800
Total NPV	$179,800	$329,890
% of CHP 1st Cost @$1,100/kW	3.27%	6.00%

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There are other factors that could increase the size of the benefits for small CHP units

- Emission allowance systems that are output-based, rather than fuel-input based, are significantly more generous to CHP systems, given their high total efficiency. The key is that "output" must include both electrical and useful thermal energy. This approach could bump up the number of surplus allowances by 200% to 250%
- Cap and trade programs are expanding to include other pollutants in state-initiated programs. These new emission allowance currencies, could augment the emission market benefits available to CHP

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For more information…

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